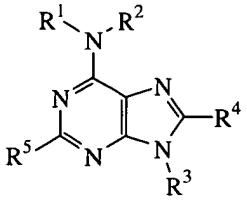
WHAT IS CLAIMED IS:

1. A method for producing a substituted purine compound of the formula:



wherein

$R^1$ is a solid support, hydrogen, alkyl, cycloalkyl, or aryl;

$R^2$ is alkyl, cycloalkyl, aryl, or a nitrogen protecting group;

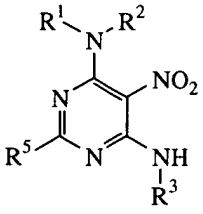
$R^3$ is hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group;

$R^4$ is hydrogen, alkyl, aryl, or $-NR^6R^7$, where each of $R^6$ and $R^7$ is independently hydrogen, alkyl, aryl, or cycloalkyl; and

$R^5$ is alkyl, alkoxy, alkenyl, alkynyl, aryl, aryloxy, cycloalkyl, cycloalkoxy, thioalkyl, thioaryl, or $-NR^8R^9$, where each of $R^8$ and $R^9$ is independently hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group, or $R^8$ and $R^9$ together with the nitrogen atom to which they are attached to form heterocyclyl;

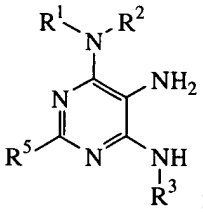
said method comprising:

(a) contacting a 5-nitropyrimidine compound of the formula:



;

with a reducing agent to produce a 4,5,6-triaminopyrimidine of the formula:



;

and

(b) forming a purine ring by contacting the 4,5,6-triaminopyrimidine with a cyclizing agent to produce the substituted purine.

2. The method of Claim 1, wherein $R^1$ is a solid support.

3. The method of Claim 2, wherein $R^2$ is a nitrogen protecting group.

4. The method of Claim 2, wherein the reducing agent is selected from the group consisting of:

(a) $CrX_2$, wherein each X is independently halide, and

(b) a mixture of 1,1'-dialkyl-4,4'-bipyridinium dihalide and a thiosulfate compound.

5. The method of Claim 4, wherein the nitro reducing step (a) comprises a presence of a protic solvent.

6. The method of Claim 4, wherein the 4,5,6-triaminopyrimidine produced in said step (a) is substantially free of inorganic salts.

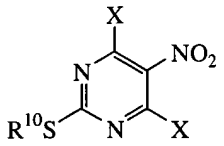
7. The method of Claim 4, wherein substantially all of the solid support-bound pyrimidine ring remains bound to the solid support during said nitro group reducing step (a).

8. The method of Claim 2 further comprising cleaving the substituted purine from the solid support to produce the purine compound where $R^1$ is hydrogen.

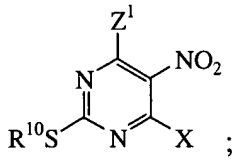
9. The method of Claim 1, wherein the cyclizing agent is an orthoester, an acyl anhydride, an acyl halide, a mixture of isothiocyanate and an oxidizing agent, a mixture isocyanate and an oxidizing agent, or a mixture of an aldehyde and an oxidizing agent.

10. The method of Claim 1, wherein the 5-nitropyrimidine compound is produced by steps comprising:

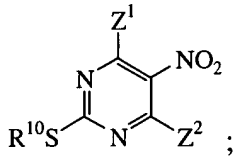
(a) contacting a 4,6-dihalo-5-nitro-2-thioether pyrimidine of the formula:



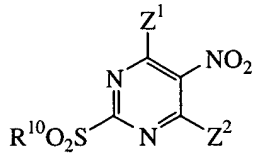
with a first amine compound of the formula $Z^1H$ to produce a 6-aminopyrimidine of the formula:



(b) contacting the 6-aminopyrimidine with a second amine compound of the formula $Z^2H$ to produce a 4,6-diaminopyrimidine of the formula:



(c) contacting the 4,6-diamino pyrimidine with an oxidizing agent to produce a 2-sulfonylpyrimidine of the formula:



; and

(d) contacting the 2-sulfonylpyrimidine with a nucleophile of the formula $R^5$–M to produce the 5-nitropyrimidine compound,

wherein

one of $Z^1$ and $Z^2$ is $-NR^1R^2$ and the other is $-NHR^3$;

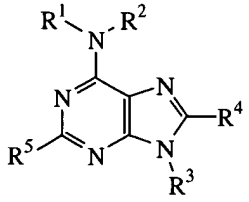
$R^1$, $R^2$, $R^3$, and $R^5$ are those defined in Claim 1;

$R^{10}$ is alkyl, cycloalkyl, or aryl;

M is hydrogen, metal, or a metal complex; and

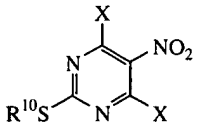
each X is independently halide.

11. A method for producing a substituted purine of the formula:

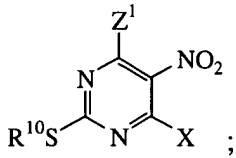


said method comprising:

(a) contacting a 4,6-dihalo-5-nitro-2-thioether pyrimidine of the formula:

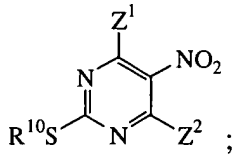


with a first amine compound of the formula $Z^1H$ to produce a 6-aminopyrimidine of the formula:



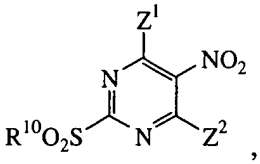
;

(b) contacting the 6-aminopyrimidine with a second amine compound of the formula $Z^2H$ to produce a 4,6-diaminopyrimidine of the formula:



;

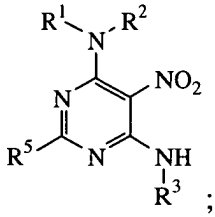
(c) contacting the 4,6-diaminopyrimidine with an oxidizing agent to produce a 2-sulfonylpyrimidine of the formula:



,

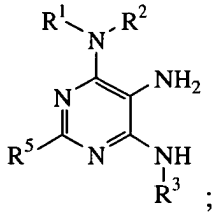
wherein one of $Z^1$ and $Z^2$ is $-NR^1R^2$ and the other is $-NHR^3$;

(d) contacting the 2-sulfonylpyrimidine with a nucleophilic compound of the formula $R^5$–M to produce a 5-nitropyrimidine of the formula:



;

(e) contacting the 5-nitropyrimidine with a reducing agent to produce a 4,5,6-triaminopyrimidine of the formula:



;

and

(f) contacting the 4,5,6-triaminopyrimidine with a cyclizing agent to produce the library of substituted purines,

wherein

M is hydrogen, a metal or a metal complex;

$R^1$ is hydrogen, alkyl, cycloalkyl, aryl, or a solid support;

$R^2$ is alkyl, cycloalkyl, or aryl;

$R^3$ is hydrogen, alkyl, cycloalkyl, or aryl;

$R^4$ is hydrogen, alkyl, aryl, or $-NR^6R^7$, where each of $R^6$ and $R^7$ is independently hydrogen, alkyl, aryl, or cycloalkyl; and

$R^5$ is alkyl, alkoxy, alkenyl, alkynyl, aryl, aryloxy, cycloalkyl, cycloalkoxy, thioalkyl, thioaryl, or $-NR^8R^9$, where each of $R^8$ and $R^9$ is independently hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group, or $R^8$ and $R^9$ together with the nitrogen atom to which they are attached to form heterocyclyl.

12. The method of Claim 11, said method is used to produce a combinatorial library of substituted purine compounds.

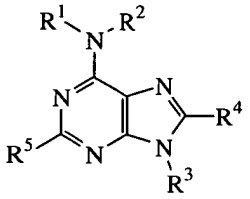
13. The method of Claim 12, wherein $R^1$ is a solid support and wherein the library of substituted purines is a library of solid support-bound substituted purines.

14. The method of Claim 13, wherein each purine compound in the combinatorial library is spatially separated.

15. The method of Claim 13, wherein the combinatorial library is formed on a plurality of particles, each particle having a surface coating of purine molecules of the same substituents.

16. The method of Claim 13 further comprising cleaving the solid support-bound substituted purines from the solid support to produce a library of non-solid support-bound substituted purines.

17. A combinatorial library of purines, wherein each purine in the library is of the formula:



wherein

$R^1$ is a solid support, hydrogen, alkyl, cycloalkyl, or aryl;

$R^2$ is alkyl, cycloalkyl, aryl, or a nitrogen protecting group;

$R^3$ is hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group;

$R^4$ is hydrogen, alkyl, aryl, or $-NR^6R^7$, where each of $R^6$ and $R^7$ is independently hydrogen, alkyl, aryl, or cycloalkyl; and

$R^5$ is alkyl, alkoxy, alkenyl, alkynyl, aryl, aryloxy, cycloalkyl, cycloalkoxy, thioalkyl, thioaryl, or $-NR^8R^9$, where each of $R^8$ and $R^9$ is independently hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group, or $R^8$ and $R^9$ together with the nitrogen atom to which they are attached to form heterocyclyl.

18. The combinatorial library of Claim 17, wherein $R^1$ is a solid support.

19. A method for reducing a nitro substituent on a pyrimidine ring which is covalently attached to a solid support, wherein the pyrimidine ring is optionally substituted with one, two, or three independent non-hydrogen substituents, said method comprising:

(a) reducing the nitro functional group to an amino functional group by contacting the solid support-bound pyrimidine compound with chromium dihalide to produce a reaction mixture comprising a solid support-bound amino pyrimidine compound; and

(b) removing the solid support-bound amino pyrimidine compound from the reaction mixture,

wherein the solid support-bound amino pyrimidine compound that is removed from the reaction mixture is substantially free of inorganic salts.

20. The method of Claim 19, wherein substantially all of the solid support-bound pyrimidine ring remains covalently bound to the solid support during said nitro group reducing step (a).

21. The method of Claim 19, wherein the reaction mixture further comprises a protic solvent.

22. The method of Claim 19, wherein the chromium dihalide is chromium dichloride.